

REMARKS

Claims 1-20 are pending in this application. Claims 1 and 11 are independent claims. Claims 11-16 were previously withdrawn from consideration. Reconsideration and allowance of the present application are respectfully requested.

Claims 1-10 and 17-20 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 3,356,748 to Drinkard et al. (hereinafter also referred to as “Drinkard”) in view of U.S. Patent No. 6,242,633 to Fischer et al. (hereinafter also referred to as “Fischer”) and International Publication No. WO 02/26698 to Jungkamp et al. (hereinafter also referred to as “Jungkamp”). The cited references do not render obvious the present invention.

The present invention describes a process for preparing 3-pentenenitrile by isomerizing streams comprising 2-methyl-3-butenenitrile. This forms a stream 1 which comprises an isomerization catalyst, 2-methyl-3-butenenitrile, 3-pentenenitrile and (Z)-2-methyl-2-butenenitrile. Later in the process, 3-pentenenitrile is obtained by distillation, 2-methyl-3-butenenitrile is recycled and a fraction in which (Z)-2-methyl-2-butenenitrile is enriched is discharged.

The process according to the invention differs essentially in the parameters in (c) of claim 1. The parameters in (c) of claim 1 are not described in any of the citations and cannot be derived from the citations or combination thereof without exercising inventive skill. In particular, claim 1 recites distilling stream 2 at a bottom temperature of 40 to 180°C and a pressure of 10 mbar to 500 mbar. It is evident from step (c) that the distillation of a stream 2 affords a top product 4 in which (Z)-2-methyl-2-butenenitrile is enriched compared to stream 2, based on the sum of all pentenenitriles. The bottom product obtained is a stream 5 in which 3-pentenenitrile and 2-methyl-3-butenenitrile is enriched compared to stream 2, based on the sum of all pentenenitriles.

Removal of as much as possible (Z)-2-methyl-2-butenenitrile is necessary since it otherwise accumulates in the 2-methyl-3-butenenitrile because the boiling point difference from 2-methyl-3- butenenitrile is too small. The boiling point of (Z)-2-methyl-2-butenenitrile is 120-123°C at 1013 mbar and that of 2-methyl-3-butenenitrile is 124°C at 1013 mbar.

US Patent 3,865,865, cited in the present application, and which also refers to Drinkard (please see column 1, line 21), states that the distillative removal of 2-methyl-2- butenenitrile (2M2BN) from mixtures with 3-pentenenitrile and 2-methyl-3-butenenitrile (2M3BN) presents difficulties (please see column 1, lines 26 to 29). This evidences the conventional wisdom in the art of leading away from separation by distillation of nitriles having boiling points that are close together. Therefore, US Patent 3,865,865 proposes reacting the reaction mixture from the isomerization with aqueous alkali metal sulfite/alkali metal bisulfite solutions to give adducts which can be extracted from the reaction mixture with water. This process is very complex since it constitutes an additional process step.

As appreciated by the examiner, Drinkard fails to disclose the crucial distillation step (c) discussed above and distillation step (d), which recites distilling stream 5 at a pressure of 0.001 bar to 100 bar to obtain a stream 6 as the bottom product which comprises 3-pentenenitrile and a stream 7 as the top product which comprises 2-methyl-3-butenenitrile, the (Z)-2-methyl-2- butenenitrile-depleted 2-methyl-3-butenenitrile being recycled to step (a). By contrast to the present invention, Drinkard relates to the isomerization of 2-methyl-3-butenenitrile with a Ni [P (OC₂H₅)₃]₄ catalyst, so as to yield a liquid product stream which is then vacuum-distilled. The distillate includes 2-methyl-3-butenenitrile, 3-pentenenitrile, 2-methyl-2-butenenitrile and 4- pentenenitrile. The bottom stream composition is not further described, but one would expect it to contain the catalytic system and possible solvents.

As mentioned above, the subject matter of present claim 1 clearly differs from Drinkard, i.e., by the above-recited distillation steps (c) and (d). This presently claimed combination of features is neither known nor can be directly derived from Drinkard, either alone or in combination with Fischer and Jungkamp. In particular, the Office has not shown that there would be an apparent reason to modify Drinkard with Fischer and Jungkamp¹.

¹ In fact, the conclusion in the International Preliminary Report on Patentability was that the claims were novel, inventive and had industrial utility.

Fischer² does not overcome the above deficiencies of Drinkard with respect to rendering unpatentable the present invention. Fischer fails to suggest the crucial distillation steps (c) and (d) according to the present invention. Fischer was relied upon for a disclosure of nickel isomerizaton catalysts.

WO 02/26698 to Jungkamp³ does not overcome the above deficiencies of Drinkard with respect to rendering unpatentable the present invention. Jungkamp describes the distillative separation of certain pentenenitrile isomers in the presence of a liquid diluent, especially water. The diluent forms azeotropes with the pentenenitrile isomers. Jungkamp does disclose the distillative separation of (Z)-2-methyl-2-butenenitrile and 2-methyl-3-butenenitrile. Instead Jungkamp discloses the distillative separation of (E)-2-methyl-2-butenenitrile and 2-methyl-3-butenenitrile. However, the separation by distillation of (Z)-2-methyl-2-butenenitrile and 2-methyl-3-butenenitrile is much more complex than the separation by distillation of (E)-2-methyl-2-butenenitrile and 2-methyl-3-butenenitrile because the boiling points of (Z)-2-methyl-2-butenenitrile and 2-methyl-3-butenenitrile are closer together than those of (E)-2-methyl-2-butenenitrile and 2-methyl-3-butenenitrile. As mentioned above, the boiling point of (Z)-2-methyl-2-butenenitrile is 120-123°C at 1013 mbar and that of 2-methyl-3-butenenitrile is 124°C at 1013 mbar. In fact, if anything, Jungkamp actually leads away from the present invention since Jungkamp was aware of the need to separate (Z)-2-methyl-2-butenenitrile (please see, for instance, column 1, paragraph [00008]),but did not include it in any of the isomer mixtures subject to the processes discussed therein. This indicates that persons skilled in the art would not have adapted the disclosure of Jungkamp to separating (Z)-2-methyl-2-butenenitrile and 2-methyl-3-butenenitrile. Nothing in Jungkamp suggests that nitrile compounds having boiling points close together can be separated by distillation and contrary to the conventional wisdom in the art as expressed in US Patent 3,865,865, discussed above.

The separation in Jungkamp is based upon the addition of water as an entrainer. Working under vacuum is not a preferred separation method according to Jungkamp. Consequently,

² Fischer is assigned to BASF, the assignee of this application and includes an inventor that is also a named inventor in this application.

³ Jungkamp is assigned to BASF, the assignee of this application and includes named inventors that are also named inventors in this application.

working under vacuum for separation of a mixture with boiling points much closer to each other than those of the mixtures disclosed in Jungkamp is not obvious in light of Jungkamp.

Advantages of the method according to the present invention are the reduced energy expenditure, improved separation and the advantage that the product does not need to be dried.

With respect to pressure, Jungkamp states that the distillation can be performed at a pressure in the range from 1 to 200/kPa (0.01 to 2 bar), preferably 50 to 100 kPa (0.5 to 1 bar), especially at standard pressure (Jungkamp, page 5 lines 24 to 26). However, persons skilled in the art would not have performed the distillation under reduced pressure for at least the following reasons:

- a) the preferred distillation at standard pressure leads away from working under reduced pressure
- b) there are no working examples in Jungkamp for working under reduced pressure
- c) the distillative separation of (Z)-2-methyl-2-butenenitrile and 2-methyl-3-butenenitrile is not described in Jungkamp.

In addition, pressure is not disclosed as a result-effective parameter. As set forth in MPEP §2144.05 II. (B), only result-effective variables can be optimized. Specifically, a particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the workable ranges of the variable might be characterized as routine experimentation or an obvious choice of expedients or design choice. Also, please see *In re Antonie*, 559 F.2d 618, 195 USPQ 6 (CCPA 1977). No such recognition is disclosed in the cited art.

Examples are compiled below regarding the pressure dependence of the distillative (Z)-2-methyl-2- butenenitrile/2-methyl-3-butenenitrile separation (please see WO 2005/73179, pages 23-24).

The following abbreviations are used:

T3PN	trans-3-pentenenitrile
C3PN	cis-3-pentenenitrile
4PN	4-pentenenitrile
2M3BN	2-methyl-3-butenenitrile
T2PN	trans-2-pentenenitrile
C2PN	cis-2-pentenenitrile
E2M2BN	(E)-2-methyl-2-butenenitrile
Z2M2BN	(Z)-2-methyl-2-butenenitrile
VSN	valeronitrile
VCH	4-vinylcyclohexene

The separation of the starting mixture comprising trans-3-pentenenitrile, 2-methyl-3-butenenitrile and (Z)- 2-methyl-2-butenenitrile as main components (Table 1) is performed in a distillation column with evaporator, total condenser and reflux divider. The distillation column has 15 theoretical plants. The return ratio m(removal)/rn(return to column) is 50. The feed into the evaporator is at 10 kg/h into the bottom of the column; the removal at the top is at 0.05 kg/h.

Table 1

Constituent	Feed, % by weight
T3PN	58
C3PN	1
4PN	1
2M3BN	21
T2PN	0
C2PN	1
E2M2BN	1

Z2M2BN	16
VSN	0
VCH	1

Table 2

Example	Pressure (bar)	Bottom temperature °C	Top temperature °C	2M3BN in tops % by weight	Z2M2BN in tops % by weight
1	1.000	133	119	23	77
2	0.500	110	97	22	77
3	0.200	84	71	21	78
4	0.100	68	55	20	79
5	0.050	53	40	19	80
6	0.020	38	22	17	82

Examples 1 to 6 (Table 2) show that, with the same return ratio and same removal rates, the lower the pressure established in the column, the higher the efficiency of the separation of 2-methyl-3-butenenitrile and (Z)-2-methyl-2-butenenitrile; at lower pressure, the residual content of 2-methyl-3-butenenitrile in the top draw decreases and the content of the (Z)-2-methyl-2-butenenitrile to be removed in the tops increases.

Examples in the specification demonstrate unexpected results achievable by the present invention. Along these lines, the claimed process provides low losses of 2-methyl-3 butenenitrile during distillative separation of (Z) 2-methyl-2- butenenitrile (cf. example 1-4 of the present specification). This is surprising since the boiling points of both compounds differ only slightly from each other.

Moreover, the relative antiquity of Drinkard is further indicia of the non-obviousness of the present invention. Along these lines, please see *In re Adams* 148 USPQ 743 (CCPA, 1966) and *In re Lechen*, 125 USPQ 396 (CCPA, 1960).

In conjunction with interpreting 35 U.S.C. §103 under *Graham V. John Deere*, 383 U.S. 1, 148 U.S.P.Q. 459 (1966) and *KSR Int'l Co. v. Teleflex, Inc*, 127 S. Ct. 1727 (2007), the initial burden is on the Patent Office to provide some apparent reason or suggestion of the desirability of doing what the inventor did, i.e. the Patent Office must establish a *prima facie* case of obviousness. To support the conclusion that the claimed invention is directed to obvious subject

matter, either the references must expressly or impliedly suggest the claimed invention, or the Examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references. Moreover, MPEP, § 706.02(j), states that "To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references. Also, please see *Ex parte Clapp*, 227 USPQ 972, 973 (Bd. Pat. App. & Inter. 1985).

In addition, the prior art reference (or references, when combined) must teach or suggest all of the claim limitations.

The mere fact that cited art may be modified in the manner suggested in the Office Action does not make this modification obvious, unless the cited art suggests the desirability of the modification or impliedly suggests the claimed invention, or the Examiner has presented a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references. No such suggestion appears in the cited art in this matter nor has a convincing line of reasoning been presented in this case. The Examiner's attention is kindly directed to *KSR Int'l Co. v. Teleflex, Inc*, supra; *In re Dembiczak et al*, 50 USPQ2d.1614 (Fed. Cir. 1999), *In re Gordon*, 221 USPQ 1125 (Fed. Cir. 1984), *In re Laskowski*, 10 USPQ2d, 1397 (Fed. Cir. 1989) and *In re Fritch*, 23, USPQ2d. 1780 (Fed. Cir. 1992).

Furthermore, the cited art lacks the necessary direction or incentive to those of ordinary skill in the art to render a rejection under 35 USC 103 sustainable. The cited art fails to provide the degree of predictability of success of achieving the properties attained by the present invention needed to have a rejection under 35 U.S.C. 103 sustained. See *KSR Int'l Co. v. Teleflex, Inc*, 127 S. Ct. 1727 (2007), *Diversitech Corp. v. Century Steps, Inc.*, 7 USPQ2d 1315 (Fed. Cir. 1988), *In re Mercier*, 187 USPQ 774 (CCPA 1975) and *In re Naylor*, 152 USPQ 106 (CCPA 1966). In particular, the claimed process provides low losses of 2-methyl-3 butenenitrile during distillative separation of (Z) 2-methyl-2- butenenitrile (cf. example 1-4 of the present

specification). This is quite surprising since the boiling points of both compounds are only slightly different.

Moreover, the properties of the subject matter and improvements which are inherent in the claimed subject matter and disclosed in the specification are to be considered when evaluating the question of obviousness under 35 USC 103. See *KSR Int'l Co. v. Teleflex*,¹ *supra*, *Gillette Co. v. S.C. Johnson & Son, Inc.*, 16 USPQ2d 1923 (Fed. Cir. 1990), *In re Antonie*, 195 USPQ 6 (CCPA 1977), *In re Estes*, 164 USPQ 519 (CCPA 1970), and *In re Papesch*, 137 USPQ 43 (CCPA 1963).

No property can be ignored in determining patentability and comparing the claimed invention to the prior art. Along these lines, see *In re Papesch*, *supra*, *In re Burt et al*, 148 USPQ 548 (CCPA 1966), *In re Ward*, 141 USPQ 227 (CCPA 1964), and *In re Cescon*, 177 USPQ 264 (CCPA 1973).

In view of the above, consideration and allowance are respectfully solicited.

In the event the Examiner believes an interview might serve in any way to advance the prosecution of this application, the undersigned is available at the telephone number noted below.

The Office is authorized to charge any necessary fees due with this paper to Deposit Account No. 22-0185, under Order No. 12810-00322-US1 from which the undersigned is authorized to draw.

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Respectfully submitted,

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